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With international search report.

(54) Title: INSECTICIDE COMPOSITIONS

(57) Abstract

This invention provides a novel insecticide composition having a bicarbonate-containing inorganic salt ingredient which enhances the efficacy of an insecticidal ingredient for the treatment of cultivated crops. An invention insecticide composition also contains a water-soluble organic compound which functions as a compatibility enhancing ingredient in aqueous formulations, and improves the spreadability and adhesiveness of the composition ingredients when applied to foliage.

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INSECTICIDE COMPOSITIONS

BACKGROUND OF THE INVENTION

A wide variety of ornamental and agricultural plants are susceptible to infestation by insects and arachnids. The pests inflict damage by consuming foliage and roots, withdrawing juices from the plants, secreting toxins, and infecting with diseases.

Field crops which require protection from pests include such valuable crops as soybeans, corn, peanuts, cotton, alfalfa and tobacco. In addition, vegetables such as tomatoes, potatoes, sugar-beets, carrots, and the like, and nuts, ornamentals, apples, peaches, peas, citrus fruit and grape also require protection from the ravages of such pests.

Insects which are difficult to control include those which inhabit the soil and cause destruction of the root systems of valuable agricultural crops. Corn rootworms are the larvae of several beetle species of the genus Diabrotica. The adult beetles lay their eggs in the soil of a maturing corn crop. The eggs lay dormant in the soil until the following spring, then they hatch in response to favorable soil temperatures and the larvae feed on the roots of young corn plants causing reduction in yield.

A broad scope of insecticide compounds have been developed to combat insects which are harmful to agricultural and horticultural plants.

Illustrative of insecticide compositions are those described in United States Patent Numbers 3,217,037; 3,506,698; 3,576,834; 3,636,111; 3,755,364; 3,875,232; 4,028,413; 4,128,581; 4,415,743; 4,640,927; 4,804,653; 4,839,349; 5,010,068; 5,087,456; 5,087,456; 5,096,928; and references cited therein.

There remains a continuing need for the development of new and more effective insecticides which possess contact or systemic insecticidal activity for the protection of cultivated plants, with a minimum of phytotoxic side effects.

Accordingly, it is an object of this invention to provide a biocide composition which is a blend of inorganic and organic compounds exhibiting insecticidal properties.

It is another object of this invention to provide an insecticide composition which is a dry blend of ingredients which include a bicarbonate salt which enhances the biocidal activity of an insecticide ingredient.

Other objects and advantages of the present invention shall become apparent from the accompanying description and examples.

DESCRIPTION OF THE INVENTION

One or more objects of the present invention are accomplished by the provision of an insecticide composition which is a dry blend formulation comprising (1) an ingredient selected from alkali metal and ammonium bicarbonates; (2) a compatibility enhancing ingredient selected from water-soluble organic compounds which are in solid form at a temperature below about 10°C; and (3) an organic insecticide ingredient.

In another embodiment this invention provides an aqueous insecticide formulation having a content comprising (1) an ingredient selected from alkali metal and ammonium bicarbonates; (2) a compatibility enhancing ingredient selected from water-soluble organic compounds which are in solid form at a temperature below about 10°C; and (3) an organic insecticide ingredient.

The inorganic salt ingredient is selected from compounds which include sodium bicarbonate, potassium bicarbonate, lithium bicarbonate and ammonium bicarbonate. In a further embodiment, the inorganic salt ingredient can include an additional compound selected from sodium carbonate, potassium carbonate, lithium carbonate and ammonium carbonate.

The inorganic salt ingredient typically will comprise between about 10-80 weight percent, based on the weight of dry blend formulation.

Illustrative of inorganic salt ingredients in a formulation are sodium, potassium, lithium or ammonium bicarbonate, or mixtures such as sodium bicarbonate and potassium bicarbonate; sodium bicarbonate and ammonium bicarbonate; potassium bicarbonate and ammonium bicarbonate; sodium bicarbonate, potassium bicarbonate and ammonium bicarbonate; sodium bicarbonate and potassium carbonate; potassium bicarbonate and potassium carbonate; and the like.

Multiple inorganic salt compounds can be utilized in a broad range of molar quantities relative to each other. The molar quantity of a carbonate salt compound normally is determined by pH control considerations when aqueous formulations are prepared. The content of a carbonate salt compound can be varied to control the pH at a desired level in the range of 7.5-12.

A compatibility enhancing ingredient of the present invention insecticide compositions is a water-soluble organic compound which is in solid form at a temperature below about 10°C. Suitable compounds include acetamide, acetylurea, alanine, aminoquanidine, aminomalonate salt, aminopyridine, arabinose, benzenesulfonate salt, benzoate salt, citraconate salt, citrate salt, crotonate salt, cyclohexanol, dihydroxyacetone, dihydroxyacetone phosphate salt, dihydroxybenzene, dimethylurea,

ethanolamine, ethyl alaninate, ethyl arsonate, ethylglycine, ethylurea, ethylenedisulfonate salt, ethyleneurea, paraformaldehyde, fucose, glutamate salt, glycerol, glycerol nitrate, glycerol phosphate salt, glycogen, glycolic aldehyde, glyoxal, guanidine, hexamine, mannitol, fructose, glucose, hydroxyurea, lactate salt, lactose, lysine, maleic amide, malonate salt, maltose, maltodextrin, methoxypyridine, methyl acetate, methyl carbamate, methyl ethyl sulfone, methyl glucoside, methylhydantoin, methylinositol, methylthiourea, methyluracil, methylurea, methylenedisulfonate salt, muconate salt, naphtholdisulfonate salt, nitrobenzoate salt, nitropentanediol, nitrophenol salt, nitrourethane, pentaglycerol, phenol, phenylenediamine, polydextrose, propionamide, propyl carbamate, propylurea, purine, pyrazine, pyrimidine, ribose, saccharate salt, sarcosinate salt, semicarbazide, sorbate salt, succinimide, sucrose, tartarate salt, tetrahydrobenzoate salt, tetrahydroquinoline, tetrazine, thiourea, threonine, triaminobenzene, triazole, triethylphosphine oxide, triethylenetetramine, trihydroxybenzene, trimethylurea, urea, xylenol, xylose, xylylene glycol, polyvinylpyrrolidone, sodium carboxymethylcellulose, xanthan gum, guar gum, locust bean gum, gum acacia, gum tragacanth, potassium alginate, potato agar, and the like.

The compatibility enhancing ingredient is incorporated in a quantity between about 0.5-20 weight percent, based on the weight of ingredients in a dry blend insecticide composition.

The term "water-soluble" as employed herein refers to a compatibility enhancing organic compound which has a solubility of at least about one gram per 100 grams of water at 25°C.

The insecticidal ingredient of an invention insecticide composition is included in a quantity which will provide a concentration between about 100 ppm and 10 weight percent of the medium which is being applied to seeds, plants, trees, harvested crops, soil, and the like. The medium can be a dry blend mixture or an aqueous spraying formulation.

The insecticide ingredient can be selected from a wide variety of organic compounds or mixtures which are known and used in agriculture and horticulture applications, such as those listed in Agricultural Chemicals, Book I, Insecticides, 1989 Revision (W. T. Thomson, Thomson Publications, Fresno, California 93791).

The general categories of insecticidal-active organic compounds include chlorinated hydrocarbon derivatives, phosphorated derivatives, pyrethroids, acylureas, and the like.

The chlorinated hydrocarbon insecticides usually act as stomach and contact poisons affecting the nervous system. They are persistent in the environment and tend to accumulate in animal fatty tissue, as exemplified by DDT and chlordane.

The organic phosphates generally are contact and/or stomach poisons. They are less persistent in the environment than the chlorinated hydrocarbons. They are toxic since they generally are cholinesterase inhibitors, which interfere with nerve impulse transmission. Most of these compounds are characterized by relatively low LD_{50} values, although the value for malathion is 1400. Parathion is one of the best known organic phosphate systemic insecticides, and is considered a dangerous material to handle.

The carbamates are similar in action to the organic phosphate insecticides. These insecticides usually are not magnified in the food chain, and are characterized by rapid breakdown.

The synthetic pyrethroids react well with synergists and exhibit relatively low mammalian toxicity. Generally they break down rapidly and leave little residue.

Illustrative of other insecticidal compounds are chlorfluazuron, chlorpyrifos, chlorpyrifos methyl, bromophos, diazinon, malathion, trichlorfon, dimethoate, phorate, lindane, toxaphene, diflubenuron, methomyl, propoxur,

carbaryl, cyhexatin, cypermethrin, permethrin, fenvalerate, dicofol, tetradifon, propargite, and the like.

Invention insecticide compositions can be in the form of dusting powders or granules, which optionally can include a solid diluent such as bentonite, calcium carbonate, magnesia, gypsum, kieselguhr, diatomaceous earth, and the like. Granules can be formed by impregnating pellets of filler with the insecticide composition ingredients, or by pelleting a dry blend insecticide composition in admixture with a powdered filler.

An invention insecticide composition also can be in the form of a dispersible powder in combination with a surfactant to facilitate dispersion of the powder in an aqueous medium. The surfactant is incorporated in an insecticide composition in a quantity between about 1-20 weight percent, based on the weight of water-insoluble ingredients.

The surfactant can be a cationic, anionic or nonionic type, or a mixture thereof. Suitable surfactants include cetyltrimethylammonium bromide; sodium lauryl sulfate; sodium dodecylbenzene-sulfonate; ammonium lignosulfonate; condensation products of ethylene oxide with fatty alcohols, amines or alkylphenols; partial esters of fatty acids and hexitol anhydrides; and the like.

The ingredients in an invention insecticide composition can be selected to include nitrogen, phosphorus and potassium elements, in a ratio that allows the composition to function as a fertilizer in addition to its function as an insecticide, when applied to cultivated crops.

An invention insecticide composition can include one or more other biologically active ingredients, such as those which exhibit herbicidal, fungicidal or plant growth regulating activity.

The amount of the pesticidally-active ingredient in an invention composition depends upon the specific pest to be combatted, as well as upon the specific insecticidal ingredient and formulation being employed, the method of applying the formulation, and the locus of treatment. Spray dilutions may be as low as a few parts per million.

When plants constitute the locus of treatment, concentration per unit area may range between about 0.01-5.0 pounds per acre, with concentrations of between about 0.1-10 pounds per acre being employed for crops such as corn, tobacco, rice, and the like.

When soil is the locus of treatment, the pesticide ingredient is applied at a rate of about 0.25-12 pounds per acre.

An insecticide composition of the present invention has a novel combination of properties for the practice of pesticide control in agricultural and horticultural applications.

A compound of the inorganic salt ingredient exhibits fungicidal properties, and the efficacy of the insecticide ingredient is enhanced by the presence of the inorganic salt ingredient. A lesser quantity of insecticide ingredient then can be employed to achieve a desired degree of pest control.

A present invention insecticide composition can be formulated to exhibit little or no phytotoxicity, or to minimize the toxic effects of salt stress on plants by the inorganic salt ingredient.

A significant feature of a present invention insecticide composition is the inclusion of a compatibility enhancing agent as an essential ingredient. Migration and settling of solid ingredients is minimized, and a dry blend formulation has a more uniformly distributed content because of the presence of the compatibility enhancing ingredient. An aqueous insecticidal formulation has exceptional long term stability, without phase separation and precipitation of solids.

As a further advantage, a present invention aqueous insecticide formulation has improved spreadability and adhesiveness when applied to plant foliage, and resists post-application insecticide drift. An applied formulation also exhibits humectant properties on coated foliage, and

increased insecticidal efficacy because of the presence of the compatibility enhancing ingredient.

The following examples are further illustrative of the present invention. The components and specific ingredients are presented as being typical, and various modifications can be derived in view of the foregoing disclosure within the scope of the invention.

EXAMPLE I

This Example illustrates the preparation of an insecticide dusting powder in accordance with the present invention.

A blend of the following ingredients is prepared:

	Parts
$KHCO_3$	30
methomyl	5
mannitol	5
talc	65

The formulated blend is milled to provide a powder with a particle size of less than 0.5 micron.

EXAMPLE II

This Example illustrates the preparation of an acylurea-containing agricultural insecticide composition.

A blend of the following ingredients is prepared as a wettable powder formulation:

	Parts
$NaHCO_3$	30
diflubenzuron	6
dihydroxybenzene	2
sodium lignosulfonate	2
kaolin	30

The formulation is dispersed in water (20% by weight solids) to form a stock medium. Aliquots of the aqueous formulation are diluted with water to 50, 100 and 500 ppm of diflubenzuron respectively, and tested for insecticidal activity.

The formulation is effective for 100 percent control of southern corn rootworm (Diabrotica undecimpunctata) larvae and tobacco budworm (Heliothis virescens) larvae.

EXAMPLE III

This Example illustrates the preparation of a granulated insecticide composition which has a high suspension capacity in water.

A mixture of the following ingredients is prepared:

	Parts
toxaphene	60
$NaHCO_3$	10
$KHCO_3$	5
hexamine	2
sodium lignosulfonate	20

The mixture is dispersed in water, and spray-dried at 180°C. The resulting granules have a 70% suspension capacity in water.

EXAMPLE IV

This Example illustrates the preparation of insecticide composition tablets which rapidly disintegrate and disperse in water.

	Parts
permethrin	40
$NaHCO_3$	35
citric acid	12
Lomar PWA 10[1]	10
glyoxal	2
sodium lignosulfonate	1

The ingredients are blended, and formed into tablets which disintegrate and disperse in water within about five minutes at 25°C.

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[1] sodium salt of alkylarylsulfonate condensation product (Jacques Wolf & Co.)

EXAMPLE V

This Example illustrates the preparation of a water-dilutable liquid concentrate insecticide composition.

A liquid concentrate is prepared from the following ingredients:

	Parts
propargite	10
$NaHCO_3$ (300 mesh)	35
$KHCO_3$ (300 mesh)	35
oleic acid monoglyceride	30
glyceryl monooctanoate	10
glycerol	5

The ingredients are admixed and heated at 40°C to form a concentrated liquid suspension. When the suspension is diluted with water, it forms a stable emulsion which has utility as an insecticide spray in agricultural applications for control of mites.

EXAMPLE VI

This Example illustrates the preparation of an aqueous insecticidal formulation stabilized with a nonionic surfactant phosphate ester salt.

	Parts
parathion	22
$KHCO_3$	10
NH_4HCO_3	10
polyoxyethylene (7.6 mol)-phenylphenol ether phosphate diethanolamine salt	5
sucrose	5
water	60

The ingredients are added to the water medium with high speed stirring to form a stable emulsion suitable for spraying of plant foliage to control insects.

EXAMPLE VII

This Example illustrates the preparation of an acaricide-fertilizer composition for application to cultivated fields.

A blend of the following ingredients is prepared:

	Parts
melamine	40
urea	30
potassium glycerol phosphate	20
tetradifon	5
$KHCO_3$	15

Granules are prepared by tumbling the blend, spraying added water to form tacky solids, and then drying the granulated product.

WHAT IS CLAIMED IS:

1. An insecticide composition which is a dry blend formulation comprising (1) an ingredient selected from alkali metal and ammonium bicarbonates; (2) a compatibility enhancing ingredient selected from water-soluble organic compounds which are in solid form at a temperature below about 10°C; and (3) an organic insecticidal ingredient.

2. An insecticide composition in accordance with claim 1 which additionally contains a surfactant ingredient.

3. An insecticide composition in accordance with claim 1 wherein the content of inorganic salt ingredient is between about 10-80 weight percent.

4. An insecticide composition in accordance with claim 1 wherein the content of inorganic salt ingredient comprises sodium bicarbonate.

5. An insecticide composition in accordance with claim 1 wherein the content of inorganic salt ingredient comprises potassium bicarbonate.

6. An insecticide composition in accordance with claim 1 wherein the content of inorganic salt ingredient comprises ammonium bicarbonate.

7. An insecticide composition in accordance with claim 1 wherein the content of inorganic salt ingredient comprises sodium bicarbonate and potassium bicarbonate.

8. An insecticide composition in accordance with claim 1 wherein the content of inorganic salt ingredient comprises sodium bicarbonate and ammonium bicarbonate.

9. An insecticide composition in accordance with claim 1 wherein the content of inorganic salt ingredient comprises potassium bicarbonate and ammonium bicarbonate.

10. An insecticide composition in accordance with claim 1 wherein the content of inorganic salt ingredient comprises sodium bicarbonate, potassium bicarbonate and ammonium bicarbonate.

11. An insecticide composition in accordance with claim 1 wherein the compatibility enhancing ingredient is a monohydroxy or polyhydroxy compound.

12. An insecticide composition in accordance with claim 1 wherein the compatibility enhancing ingredient is an amine derivative.

13. An insecticide composition in accordance with claim 1 wherein the compatibility enhancing ingredient is a carboxylic or sulfonic compound.

14. An insecticide composition in accordance with claim 1 wherein the compatibility enhancing ingredient is a phosphorus-containing compound.

15. An insecticide composition in accordance with claim 1 wherein the compatibility enhancing ingredient is a carbohydrate.

16. An insecticide composition in accordance with claim 1 wherein the compatibility enhancing ingredient is a urea or a substituted urea.

17. An insecticide composition in accordance with claim 1 wherein the compatibility enhancing ingredient is a carboxylate or sulfonate salt.

18. An insecticide composition in accordance with claim 1 wherein the compatibility enhancing ingredient is a phosphate salt.

19. An insecticide composition in accordance with claim 1 wherein the organic insecticidal ingredient is a chlorinated hydrocarbon derivative insecticide.

20. An insecticide composition in accordance with claim 1 wherein the organic insecticidal ingredient is a phosphorated derivative insecticide.

21. An insecticide composition in accordance with claim 1 wherein the organic insecticidal ingredient is a pyrethroid insecticide.

22. An insecticide composition in accordance with claim 1 wherein the organic insecticidal ingredient is an acylurea derivative insecticide.

23. An insecticide composition in accordance with claim 1 wherein the organic insecticidal ingredient is methomyl.

24. An insecticide composition in accordance with claim 1 wherein the organic insecticidal ingredient is diflubenzuron.

25. An insecticide composition in accordance with claim 1 wherein the organic insecticidal ingredient is toxaphene.

26. An insecticide composition in accordance with claim 1 wherein the organic insecticidal ingredient is permethrin.

27. An insecticide composition in accordance with claim 1 wherein the organic insecticidal ingredient is propargite.

28. An insecticide composition in accordance with claim 1 wherein the organic insecticidal ingredient is parathion.

29. An insecticide composition in accordance with claim 1 wherein the organic insecticidal ingredient is tetradifon.

30. An insecticide composition in accordance with claim 1 which contains nitrogen, phosphorus and potassium elements in a ratio which is functional as a fertilizer formulation.

31. An aqueous insecticidal formulation having a content comprising (1) an ingredient selected from alkali metal and ammonium bicarbonates; (2) a compatibility enhancing ingredient selected from water-soluble organic compounds which are in solid form at a temperature below about 10°C; and (3) an organic insecticidal ingredient.

32. An aqueous insecticidal formulation in accordance with claim 31 which additionally contains a surfactant ingredient.

33. An aqueous insecticidal formulation in accordance with claim 31 wherein the content of inorganic salt ingredient is between about 10-80 weight percent, based on the weight of ingredients.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/02187

A. CLASSIFICATION OF SUBJECT MATTER
IPC(5) :A01N 25/26,33/00,33/02,33/04,33/06,33/08,33/14,59/00; A61L 9/04
US CL :514/663 - 514/674; 424/44,421,715,716,717; 71/DIG. 1
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 1,913,631 (GRAVES) 13 June 1933. see entire document	1-12,31-33
Y	US, A, 2,204,511 (RALSTON ET AL.) 11 June 1940. see entire document	1-12,31-33
Y	US, A, 2,383,564 (RALSTON ET AL.) 28 August 1945. see entire document	1-12,31-33
Y	JP, A, 52-7438 (SAKAMOTO ET AL.) 20 January 1977, See the english abstract.	1-12,31-33
Y	CA, A, 2,013,918 (ZELLWEGER) 07 October 1990, See pp. 1-5,7,9 and 12.	1-12,31-33

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
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Date of the actual completion of the international search 12 MAY 1993	Date of mailing of the international search report 06 JUL 1993
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. NOT APPLICABLE	Authorized officer Debbie Wellman JOHN PAK Telephone No. (703) 308-1235

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International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 4,933,000 (SOMLO) 12 June 1990, See column 1, lines 13-32; columns 3-4; column 4, lines 8-9; columns 6-7; column 7, line 16.	1-12,31-33
Y	US, A, 482,403 (CARTER) 13 September 1892. see entire document	1-12,31-33
Y	US, A, 1,044,452 (HALLAND) 12 November 1912. see entire document	1-12,31-33
Y	US, A, 5,004,614 (STANIFORTH) 02 April 1991, See columns 5 and 9.	1-12,31-33
Y	The Merck Index, 1983, 10th edition, Merck & Co., Inc., pp. 818-19.	1-12,31-33

INTERNATIONAL SEARCH REPORT

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BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING
This ISA found multiple inventions as follows:

Claims 1-33 lack unity of invention, and are drawn to the following separate invention groups:

I. Claim 12, drawn to compositions containing an amine insecticidal active ingredient, classified in 514/646+.

II. Claim 13, drawn to compositions containing a carboxylic or sulfonic insecticidal active ingredient, classified in 514/557+ and 514/709+.

III. Claims 14 and 28, drawn to compositions containing a phosphorus containing insecticidal active ingredient, classified in 514/75+.

IV. Claims 15, drawn to compositions containing a carbohydrate insecticidal active ingredient, classified in 514/23+.

V. Claims 16 and 22, drawn to compositions containing a urea or acylurea insecticidal active ingredient, classified in 514/529+ and 514/709+.

VI. Claims 17,26 and 29, drawn to compositions containing carboxylate or sulfonate insecticidal active ingredient, classified in 424/601+.

VII. Claims 18 and 20, drawn to compositions containing a phosphate salt or a phosphorated derivative as the insecticidal active ingredient, classified in 424/601+.

VIII. Claim 19, drawn to compositions containing a chlorinated hydrocarbon insecticidal active ingredient, classified in 514/758.

IX. Claim 21, drawn to compositions containing a pyrethroid insecticidal active ingredient, classified in 514/65+ and others, depending on the structure on the pyrethroid.

X. Claim 23, drawn to compositions containing methomyl as the insecticidal active ingredient, classified in 514/477.

XI. Claim 24, drawn to compositions containing diflubenzuron as the insecticidal active ingredient, classified in 514/615.

XII. Claim 25, drawn to compositions containing toxaphene as the insecticidal active ingredient, classified in 514/766.

XIII. Claim 27, drawn to compositions containing propargite as the insecticidal active ingredient, classified in 514/710.

XIV. Claim 30, drawn to fertilizer compositions, classified in 71/11+.

Claims 1-11 and 31-33 are readable on any of the inventions, and thus, they will be searched to the extent that they read on the elected invention(s).

Each of the fourteen inventions above are distinct, because each utilizes a chemically distinct compound or class of compounds as the active ingredient, each is separately classified, and each has acquired a recognition in the art as separate subject for inventive effort as evidenced by the separate classifications. The search for one of the inventions would require a search in places where no pertinent art to the other inventions would exist, and thus, the search required of one of the inventions would diverge from that of another invention. The claims therefore lack unity of invention under PCT Rule 13.2 and 37CFR 1.475.

INTERNATIONAL SEARCH REPORT

International application No.
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Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Please See Extra Sheet.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-11(PART), 12 AND 31-33(PART)

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

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